

REMARKS

Claims 1-7 stand rejected under 35 U.S.C. §103(a) for obviousness from the teachings of U.S. Patent Documents 2003/0209184 to Kazandjian et al.; 5,314,651 to Kulwicki; and 4,907,043 to Uekita et al. Reconsideration is requested.

Claim 1 recites a radiation detector made from a compound comprising: $\text{Cd}_x\text{Zn}_{1-x}\text{Te}$, where $0 \leq x \leq 1$; an element from Column III or Column VII of the periodic table in a concentration about 10 to 10,000 atomic parts per billion; and a rare earth element selected from the group consisting of La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, and Lu in a concentration about 10 to 10,000 atomic parts per billion.

Paragraphs [0015] and [0064] of the Kazandjian et al. document disclose $\text{Cd}_x\text{Zn}_{1-x}\text{Te}$, where $0 \leq x \leq 1$ (hereinafter "CdZnTe") including doping elements found in Column III of the periodic table. Applicants acknowledge the Examiner's admission that the Kazandjian et al. document does not disclose, teach, or suggest doping CdZnTe with any of the rare earth elements set forth in claim 1. The Kulwicki patent discloses the use of certain ones of the rare earth elements set forth in claim 1. However it does so in connection with an improved pyroelectric material formed from barium strontium titanate or calcium-substituted barium strontium titanate (not CdZnTe) doped with at least one donor element. There is no disclosure, teaching, or suggestion in the Kazandjian et al. or Kulwicki documents to incorporate one of the rare earth elements set forth in claim 1 of the present application into CdZnTe, especially in a concentration of about 10 to 10,000 atomic parts per billion.

The Uekita et al. document does not cure the foregoing deficiencies in the Kazandjian et al. or Kulwicki documents. Specifically, column 2, lines 54-57 and column 3, lines 6-12 of the Uekita et al. document disclose that certain II-VI compounds can be tri-doped with one of the doping elements being Mn, Cu, or Ag, one of the rare earth elements listed in column 3, lines 7-8 of the Uekita et al. document, and a rare earth fluoride. However, the Uekita et al. document, does not disclose, teach, or suggest doping CdZnTe with an element from Column III or Column VII of the periodic table and one of the rare earth elements of claim 1 of the present application.

Moreover, one skilled in the art would readily recognize that the elements Mn, Cu and Ag are acceptors. In contrast, elements from Column III or Column VII of the periodic table are donors. Thus, the Uekita et al. document discloses, teaches, and suggests the use of certain rare earth elements in combination with acceptors and rare earth fluorides,

not a donor element in combination with one of the rare earth elements set forth in claim 1. Thus, the mere fact that the Uekita et al. document discloses the use of certain rare earth elements in a II-VI compound in combination with an acceptor element does not disclose, teach, or suggest the use of such rare earth elements in combination with a donor element. To this end, the teachings of the Uekita et al. document are contrary to the teachings of claim 1 and it makes no logical sense to conclude that the use of a rare earth element in combination with an acceptor element and a rare earth fluoride in a II-VI compound will have any meaningful effect in a II-VI compound in combination with a donor element.

Furthermore, the Kulwicki and Uekita et al. documents disclose rare earth element doping for the purpose of grain growth suppression and luminescence center to obtain the appropriate color, respectively. However, the Kazandjian et al., Kulwicki, and Uekita et al. documents, either individually or in combination, do not disclose, teach, or suggest doping CdZnTe with one of the rare earth elements set forth in claim 1 in connection with a radiation detector. To this end, to assume that doping CdZnTe with one of the rare earth elements that the Kulwicki document discloses is utilized for doping barium strontium titanate or calcium-substituted barium strontium titanate will have any meaningful effect or result in CdZnTe is not supported by the teachings of the Kazandjian et al., Kulwicki, and Uekita et al. documents. Stated differently, alleging that the same dopant has the same effect in vastly different materials and combinations is completely unsupported by the teachings of the Kazandjian et al., Kulwicki, and Uekita et al. documents.

Moreover, these documents, either individually or in combination, do not disclose, teach, or suggest the concentration of an element from Column III or Column VII of the periodic table (a donor element) in a concentration of 10 to 10,000 atomic parts per billion and the concentration of one of the rare earth elements of claim 1 in a concentration of about 10 to 10,000 atomic parts per billion.

In connection with the radiation detector of claim 1, it is the combination of CdZnTe with the element from Column III or Column VII of the periodic table (a donor element) in the concentration set forth in the claim and one of the rare earth elements in the concentration set forth in the claim that produces a radiation detector having excellent carrier transport properties and which fully depletes in response to an applied electric field. The Kazandjian et al., Kulwicki, and Uekita et al. documents, either individually, or in combination, do not disclose, teach, or suggest the combination set forth in claim 1.

Accordingly, these documents cannot anticipate or render obvious claim 1.

Regarding claim 2, in the rejection of claim 2, the Examiner admits that the Kazandjian et al. document does not teach that the first dopant adds shallow level donors (electrons) to the top of an energy band gap of said mixture of CdZnTe when it is solidified or that the second dopant adds deep level donors and/or acceptors to the middle of the said band gap of said mixture when it is solidified. In other words, the Kazandjian et al. document does not really teach much of anything with regard to the present invention. The Examiner goes on to allege, however, that the Kulwicki document teaches doping polycrystalline with an element from Column III of the periodic table and that such doping with certain materials will add shallow level donors (electrons) to the top of an energy band gap and that doping with other elements will add deep level donors and/or acceptors to the middle of said band gap. The Examiner further alleges that the Uekita et al. document teaches that CdTe and ZnTe are usually doped with rare earth elements.

Initially, it should be noted that the Uekita et al. document discloses the use of rare earth elements in CdTe and ZnTe in connection with Mn, Cu, and Ag, along with various rare earth fluorides set forth in column 3, line 9 of the Uekita et al. document. However, Mn, Cu, and Ag are acceptor elements in CdTe and ZnTe not donor elements, as is expressly required in claim 2.

While the Kulwicki document teaches doping polycrystalline with an element from Column III of the periodic table and a rare earth element, it does so in connection with the polycrystalline material barium strontium titanate or calcium-substituted barium strontium titanate, not a mixture of CdTe and ZnTe. It is respectfully submitted that it cannot be legitimately argued that doping barium strontium titanate or calcium-substituted barium strontium titanate with an element from Column III of the periodic table and a rare earth element teaches or suggests that mixing the element from Column III and the rare earth element with CdTe or ZnTe will produce any useful results. This is especially so where the Uekita et al. document discloses mixing a rare earth element with elements that are acceptors, not donors, the Kazandjian et al. document discloses, teaches, and suggests that doping with a rare earth element is not necessary in order to obtain useful properties in a CdZnTe semiconductor crystal.

In summary, the Kazandjian et al. document discloses CdZnTe doped with an element from Column III of the periodic table. The Kulwicki document discloses doping

barium strontium titanate or calcium-substituted barium strontium titanate with an element from Column III of the periodic table and a rare earth element, but does not disclose, teach, or suggest the applicability of such doping a mixture of Cd, Zn, and Te. The Uekita et al. document discloses the use of acceptor elements Mn, Cu, or Ag (acceptor elements) with certain rare earth elements and rare earth fluorides set forth in column 3 thereof in combination with CdTe or ZnTe. However, the use of these rare earth elements with acceptor elements and rare earth fluorides does not necessarily disclose, teach, or suggest the applicability of a rare earth element in combination with a donor element in a mixture of Cd, Zn and Te.

Accordingly, the Kazandjian et al., Kulwicki, and Uekita et al. documents, either individually or in combination, cannot anticipate or render obvious claim 2 of the present application, or claims 3-7 dependent therefrom.

Regarding the rejections of claims 5 and 7, the Examiner alleges that the Kazandjian et al. document teaches a concentration of a first dopant and a second dopant in a compound that is about 10 to 10,000 atomic parts per billion.

The Kazandjian et al. document discloses multiple doping with an element from Column III of the periodic table and iron (Fe). The Kazandjian et al. document does not disclose, teach, or suggest doping with a rare earth element. As would be readily recognized by one of ordinary skill in the art, one cannot merely substitute a rare earth element for iron in a semiconductor crystal and expect the same results. Accordingly, the mere fact that the Kazandjian et al. document discloses iron in an amount from 1 part per billion to 10 parts per million does not disclose, teach, or suggest to someone skilled in the art to dope a semiconductor crystal with a rare earth element in this same concentration.

Accordingly, the Kazandjian et al., Kulwicki, and Uekita et al. documents, either individually, or in combination, cannot anticipate or render obvious claims 5 and 7 of the present application.

Lastly, attached hereto is the International Search Report from the parent International Patent Application, namely, PCT/US03/35726, wherein the Examiner thereof deemed the Kazandjian et al. and Kulwicki documents to be only category "A" references defining the general state of the art, which is not to be considered of particular relevance.

It is respectfully submitted that when these documents along with the Uekita et al. document are considered as a whole, it cannot be obvious to combine these respective

teachings since such combination will not necessarily yield the predictable results alleged. Moreover, substitution of one element for another, as in the case of substituting a rare earth element for iron, will not necessarily yield the same results.

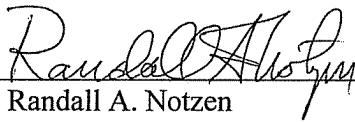
Moreover, as noted above, the Uekita et al. document teaches away from the present invention by disclosing the combination of rare earth metals with acceptors, not donors. Thus, it is submitted that the Uekita et al. document is not even prior art to the present invention.

The Kazandjian et al document teaches away from the present invention by disclosing, teaching, and suggesting the use of iron, not a rare earth element. The Kulwicki document teaches the use of rare earth elements but does so in connection with a completely different polycrystalline material, namely, barium strontium titanate or calcium-substituted barium strontium titanate, not CdZnTe. Accordingly, the various documents cited against the claims of the present application all teach in different directions with no unifying concept suggesting the desirability of any of their combinations to arrive at the claimed invention.

CONCLUSION

Based on the foregoing amendments and remarks, reconsideration of the rejection and allowance of the claims 1-7 are requested.

Respectfully submitted,
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